5.6. Honors Geometry

DATE: _____

Target 4A. Use theorems, postulates, and/or definitions to prove theorems about parallelograms

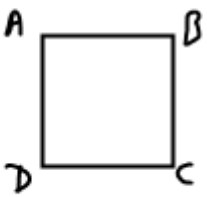
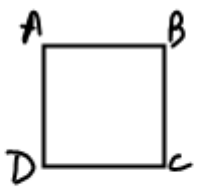
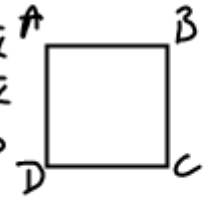
2, 3, or 4 will be on test

Did in class as warm up 12/16/13

There are five methods that can be used to prove a quadrilateral is a parallelogram.

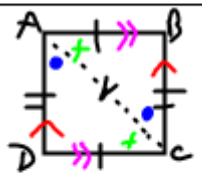
1) If both pairs of opposite sides of a quad are parallel, then the quad is a parallelogram *(reverse of the definition)*
2) If both pairs of opposite sides of a quad are congruent, then the quad is a parallelogram *(converse of property)*
3) If one pair of opposite sides of a quad are both parallel and congruent, then the quad is a parallelogram.
4) If the diagonals of a quad bisect each other, then the quad is a parallelogram. *(converse of property)*
5) If both pairs of opposite angles of a quad are congruent, then the quad is a parallelogram. *(converse of property)*

- Given
- Prove

Proof of method #1	Proof of method #2	Proof of method #3
Given: $\overline{AD} \parallel \overline{DC}$, $\overline{AD} \parallel \overline{BC}$ Prove: ▱ABCD  Proof: Definition are reversible, hence true.	Given $\overline{AD} \cong \overline{BC}$, $\overline{AB} \cong \overline{DC}$ Prove: ▱ABCD  See on next page...	Given: $\overline{AB} \parallel \overline{DC}$, $\overline{AD} \cong \overline{DC}$ Prove: ▱ABCD  See on next page ...

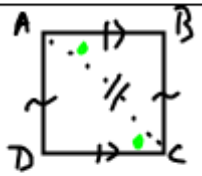
Proof of method #1

Proof of method #2



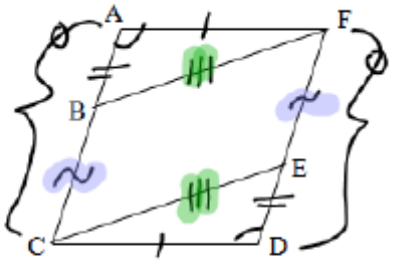
Statem.	Reasons
① $\overline{AB} \cong \overline{DC}$, $\overline{AD} \cong \overline{BC}$	① Given
② Draw $\overline{AC}$	② Two pts. determ. segment.
③ $\overline{AC} \cong \overline{AC}$	③ Refl. prop. seg
④ $\triangle ADC \cong \triangle CBA$	④ SSS
⑤ $\angle DAC \cong \angle DCA$	⑤ CPCTC
⑥ $\overline{AD} \parallel \overline{BC}$	⑥ Alt. int $\angle$s $\cong$ $\Rightarrow$ $\parallel$ lines
⑦ $\angle BAC \cong \angle DCA$	⑦ CPCTC
⑧ $\overline{AB} \parallel \overline{DC}$	⑧ Same as 6.
⑨ ▱ABCD	⑨ If 2 pairs of opp. sides $\parallel$, then ▱.

Proof of method #3



Statem.	Reasons
① $\overline{AD} \cong \overline{DC}$, $\overline{AB} \parallel \overline{DC}$	① Given
② Draw $\overline{AC}$	② Two pts. determine a seg.
③ $\overline{AC} \cong \overline{AC}$	③ Ref. prop. of seg.
④ $\angle BAC \cong \angle DCA$	④ $\parallel$ lines $\Rightarrow$ alt int. $\angle$s $\cong$
⑤ $\triangle BAC \cong \triangle DCA$	⑤ SAS
⑥ $\overline{AD} \cong \overline{BC}$	⑥ CPCTC
⑦ ▱ABCD	⑦ If both pairs opp sides $\cong$, then ▱.

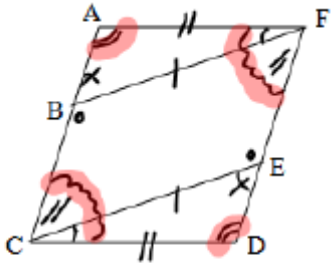
Given: Parallelogram ACDF
$\overline{AB} \cong \overline{ED}$
Prove: CBFE is a Parallelogram



Statement	Reason
① ACDF ▱ $\overline{AB} \cong \overline{ED}$	① Given
② $\angle A \cong \angle D$	② ▱ ⇒ opp. ∠s ≅
③ $\overline{AF} \cong \overline{CD}$	③ ▱ ⇒ opp. sides ≅
④ $\triangle BAF \cong \triangle EDC$	④ SAS
⑤ $\overline{AC} \cong \overline{FD}$	⑤ Same as step 3
⑥ $\overline{CB} \cong \overline{FE}$	⑥ Subtraction property
⑦ $\overline{BF} \cong \overline{CE}$	⑦ CPCTC
⑧ CBFE ▱	⑧ Both opp sides ≅ ⇒ quad ▱. (step 6 & 7) (we used method #2 from previous page)

Given: Parallelogram CBFE
$\angle ECD \cong \angle BFA$
Prove: ACDF is a Parallelogram

Given: Parallelogram CBFE
$\angle ECD \cong \angle BFA$
Prove: ACDF is a Parallelogram



Statement	Reason
① CBFE ▱, $\angle ECD \cong \angle BFA$	① Given
② $\overline{BF} \cong \overline{CE}$	② ▱ ⇒ opp. sides ≅
③ $\angle CBF \cong \angle FEC$	③ ▱ ⇒ opp. ∠s ≅
④ ∠FEC supp ∠DEF	④ If st. ∠, then supp.
⑤ ∠CBF supp ∠ABF	⑤ Same as step 4
⑥ $\angle DEF \cong \angle ADF$	⑥ Supp. of ≅ ∠s ≅. (step 3,4,5)
⑦ $\triangle BAF \cong \triangle EDC$	⑦ ASA (At this point, we can prove this using method 2 or 5) → I'll do 5, since we used 2 in previous problem
⑧ $\angle A \cong \angle D$	⑧ CPCTC
⑨ $\angle BCE \cong \angle EFB$	⑨ Same as step 3
⑩ $\angle ACD \cong \angle DFA$	⑩ Addition property (steps 1 & 9)
⑪ ▱ ACDF	⑪ Both pairs of opp. ∠s ≅ ⇒ Quad ∥gram (step 8 & 10)